



Configuring and Testing Your Network



Network Fundamentals – Chapter 11

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Objectives

- Define the role of the Internetwork Operating System (IOS).
- Use Cisco CLI commands to perform basic router and switch configuration and verification.
- Given a network addressing scheme, select, apply, and verify appropriate addressing parameters to a host.
- Use common utilities to verify network connectivity between hosts.
- Use common utilities to establish a relative performance baseline for the network.

Role of Internetwork Operating System (IOS)

- Identify several classes of devices that have IOS embedded

Cisco IOS

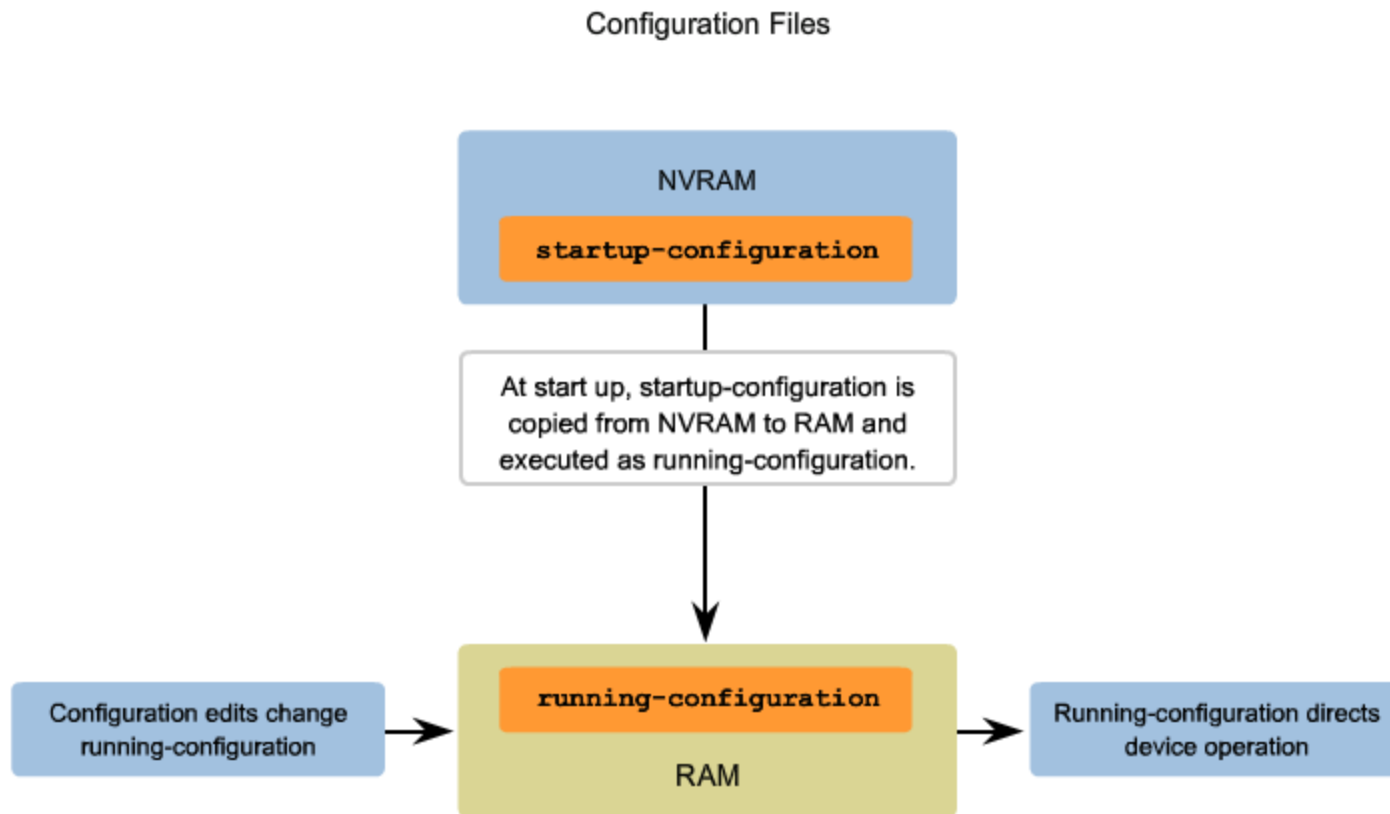


Internetwork Operating System for Cisco networking devices



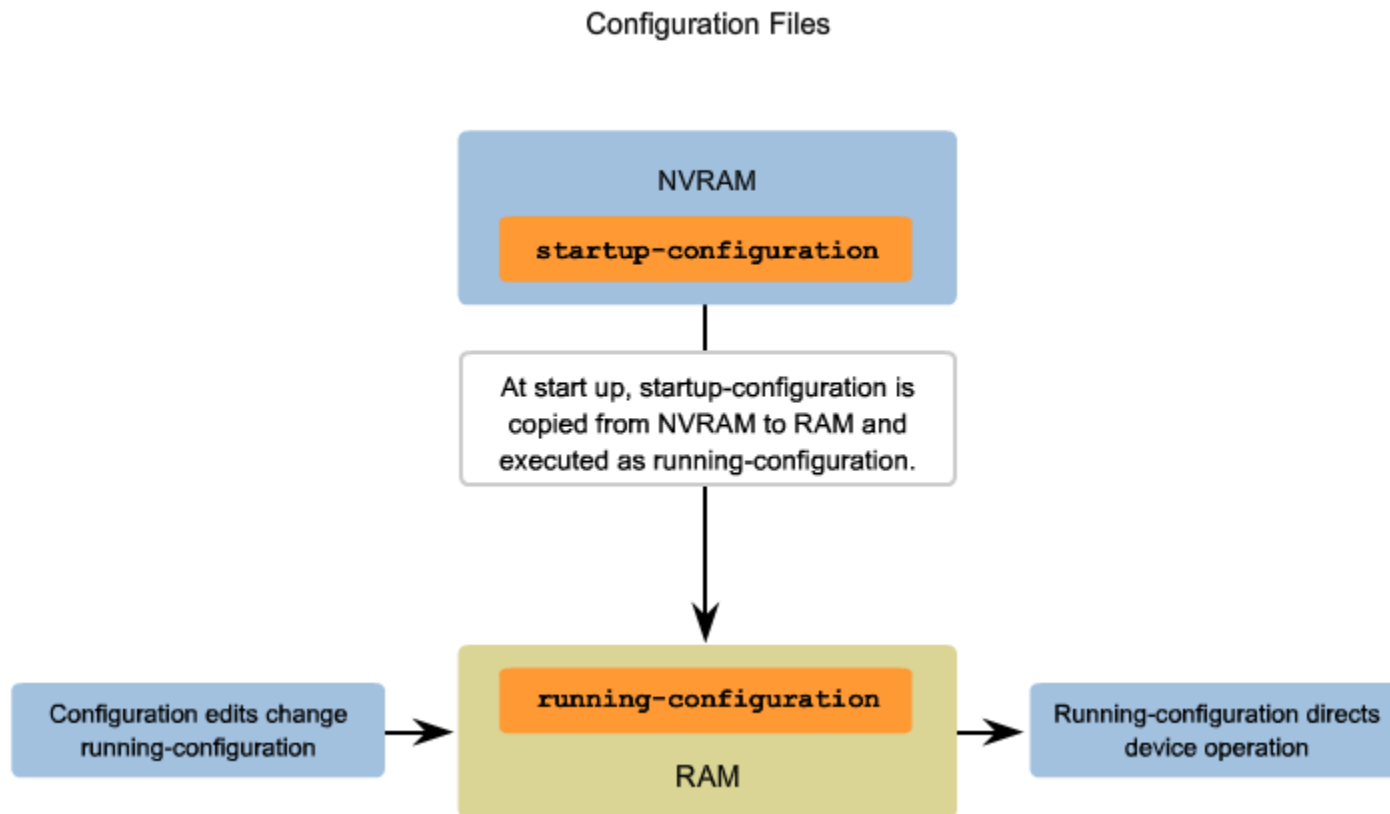
Role of Internetwork Operating System (IOS)

- Define the purpose of startup config



Role of Internetwork Operating System (IOS)

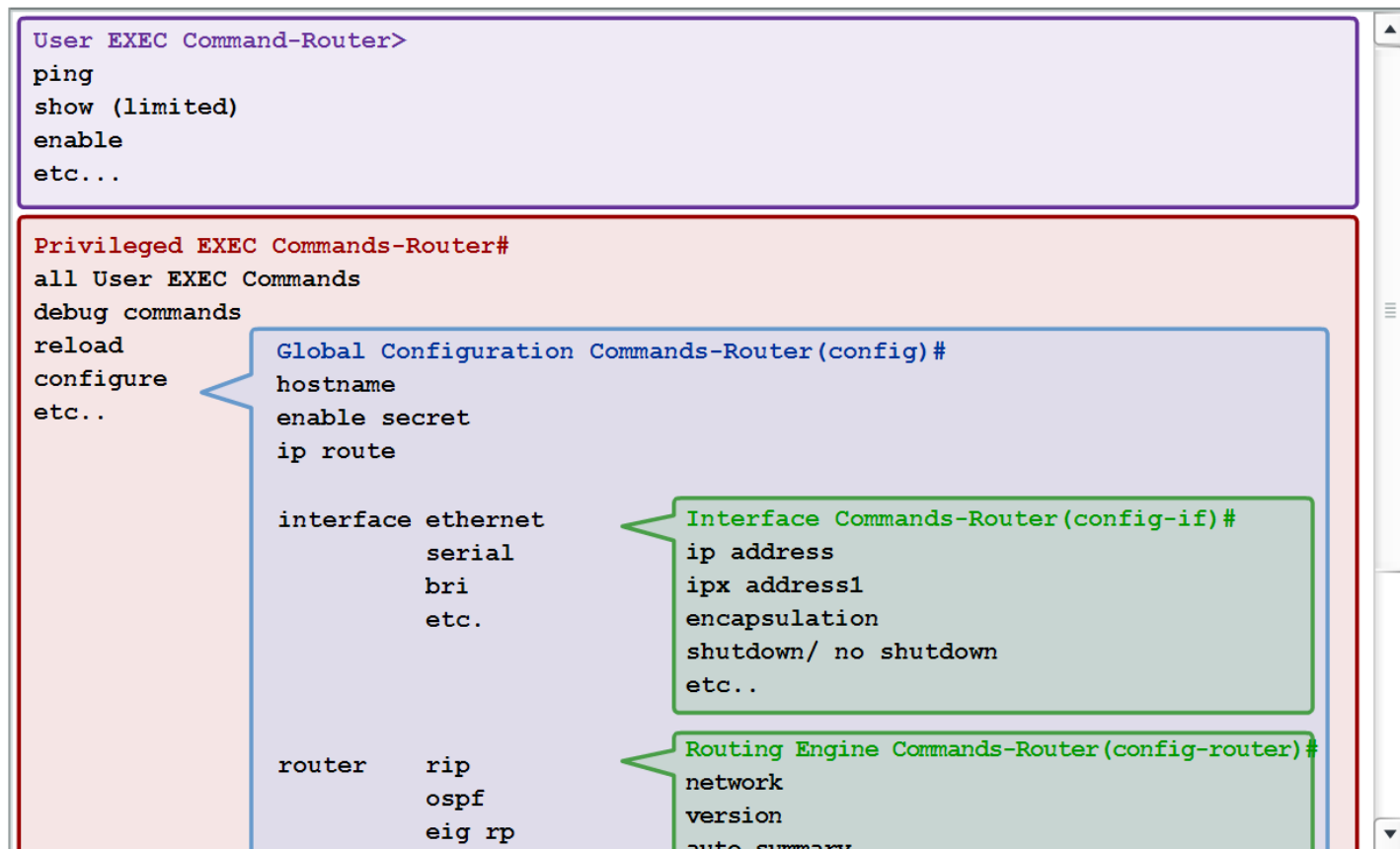
- Identify the relationship between IOS and config



Role of Internetwork Operating System (IOS)

- Recognize that Cisco IOS is modal and describe the implications of modes

IOS Mode Hierarchical Structure



Role of Internetwork Operating System (IOS)

- Define the different modes and identify the mode prompts in the CLI

IOS Primary Modes

User EXEC Mode

Limited examination of router.
Remote access.

```
Switch>
Router>
```

Global Configuration Mode

Simple configuration commands.

```
Switch (config) #
Router (config) #
```

Privileged EXEC Mode

Detailed examination of router,
Debugging and testing. File
manipulation. Remote access.

```
Switch#
Router#
```

Other Configuration Modes

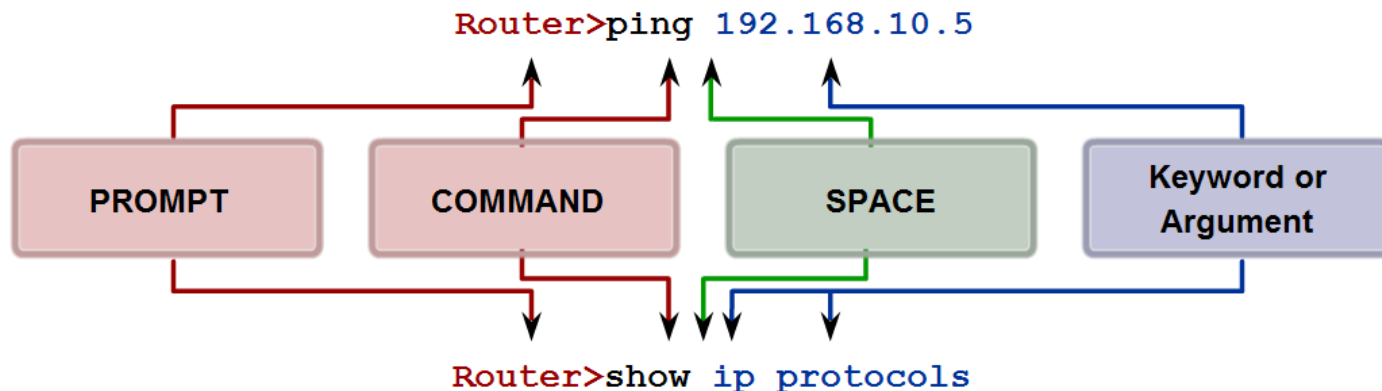
Complex and multiple-line
configurations.

```
Switch (config-mode) #
Router (config-mode) #
```


Role of Internetwork Operating System (IOS)

- Identify the basic command structure for IOS commands

Basic IOS Command Structure



Prompt commands are followed by a space and then the keyword or arguments.

Role of Internetwork Operating System (IOS)

- Identify the types of help and feedback available while using IOS and use these features to get help, take shortcuts and ascertain success

Context Sensitive Help

Example of a sequence of commands using the CLI context sensitive help

```
Cisco#cl?
clear clock
Cisco#clock ?
    set Set the time and date
Cisco#clock set
% Incomplete command.
Cisco#clock set ?
    hh:mm:ss Current Time
Cisco#clock set 19:50:00
% Incomplete command.
```

Command explanations

Incomplete Command messages

Invalid input messages

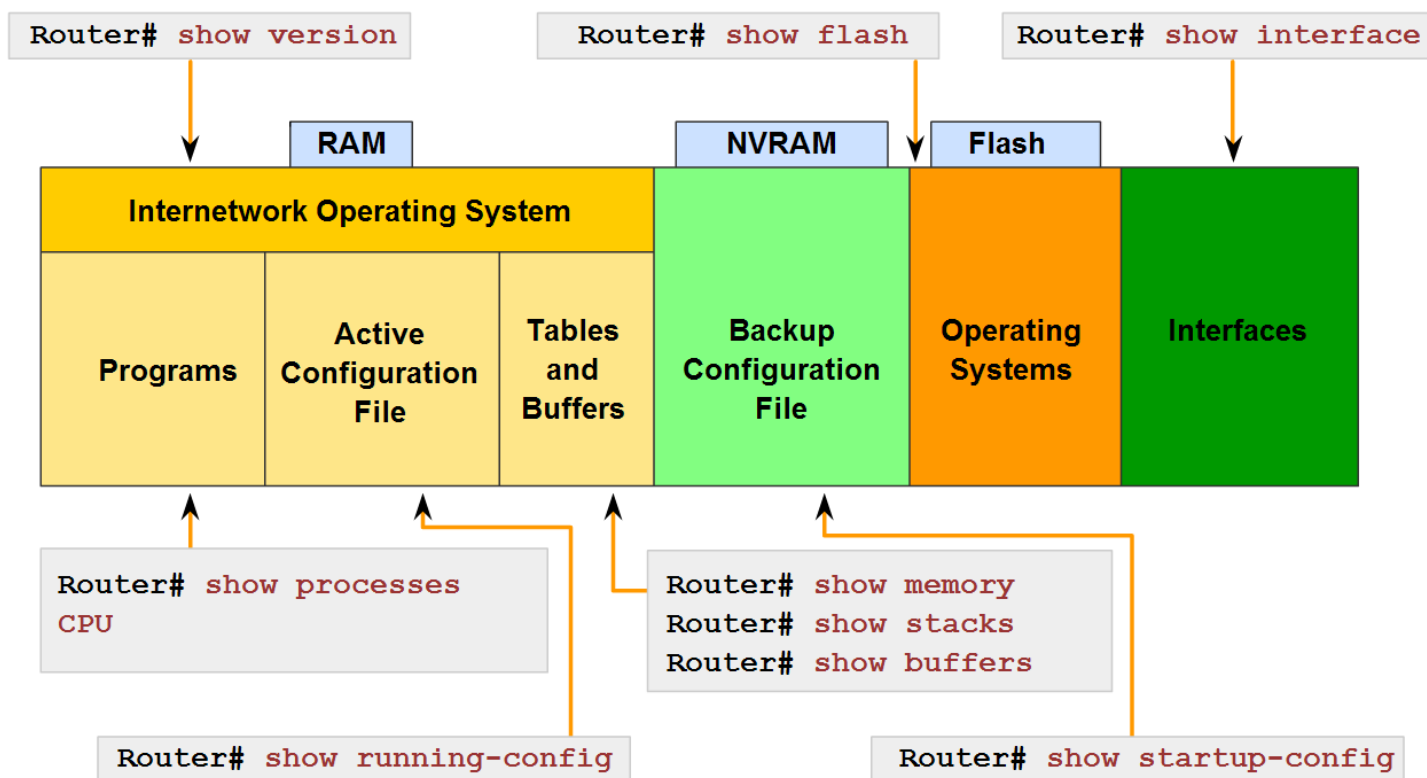
Variable formats

```
Cisco#clock set 19:50:00 ?
    <1-31> Day of the month
    MONTH Month of the year
Cisco#clock set 19:50:00 25 6
                        ^
Invalid input detected at '^' marker.
Cisco#clock set 19:50:00 25 June
% Incomplete command.
Cisco#clock set 19:50:00 25 June ?
    <1993-2035> Year
Cisco#clock set 19:50:00 25 June 2007
Cisco#
```

Role of Internetwork Operating System (IOS)

- Identify the purpose of the show command and several of its variations

IOS show commands can provide information about the configuration, operation and status of parts of a Cisco router.



Role of Internetwork Operating System (IOS)

- Identify several of the configuration modes, their purpose and their associated prompt

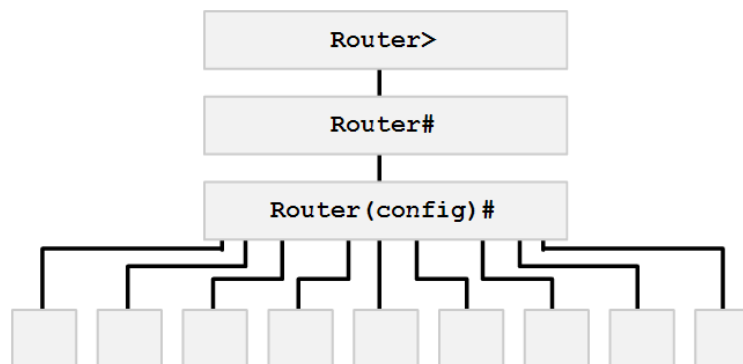
IOS Configuration Modes

User EXEC mode

Privileged EXEC mode

Global configuration mode

Specific configuration mode

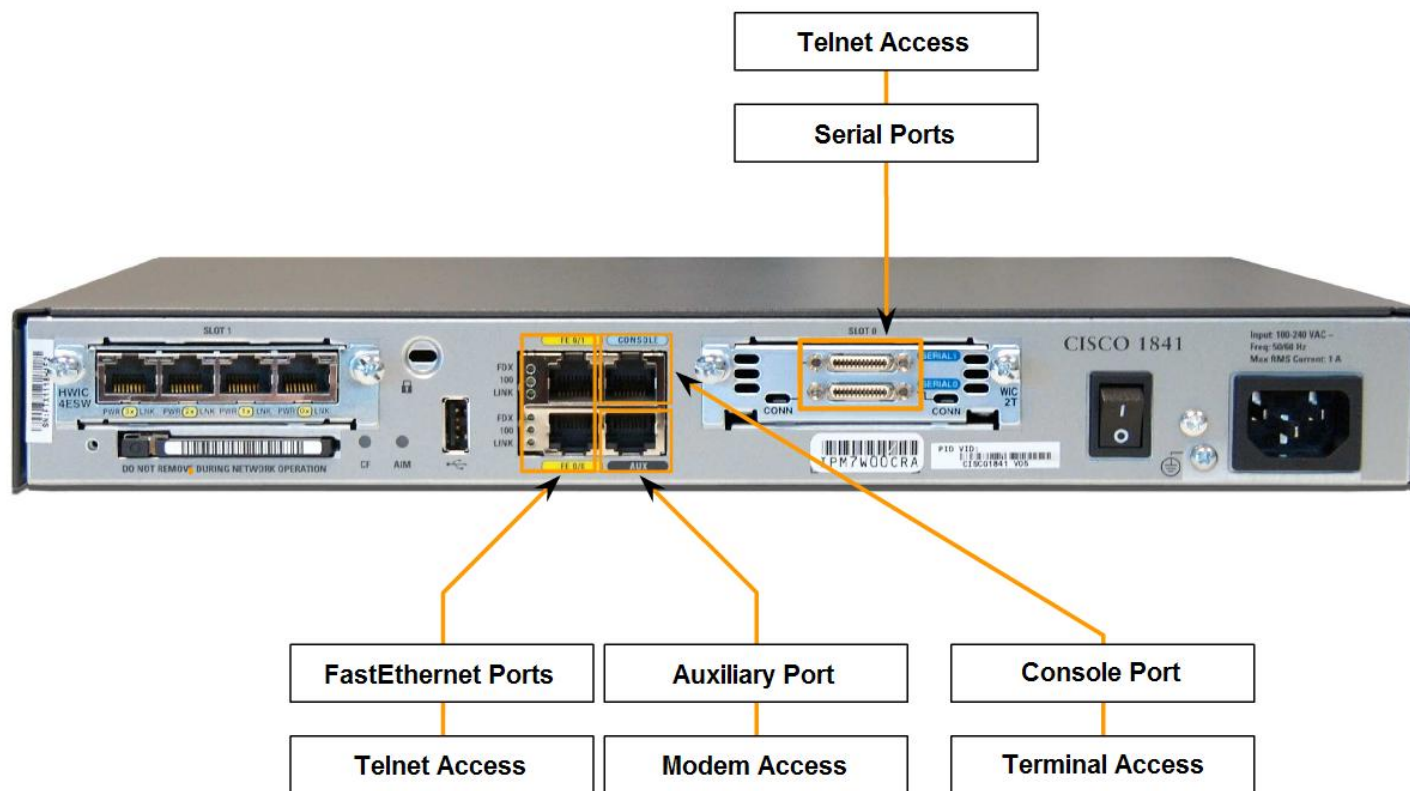


Configuration Mode	Prompt
Interface	Router (config-if) #
Line	Router (config-line) #
Routers	Router (config-router) #

Role of Internetwork Operating System (IOS)

- Use the CLI to access various IOS configuration modes on a device

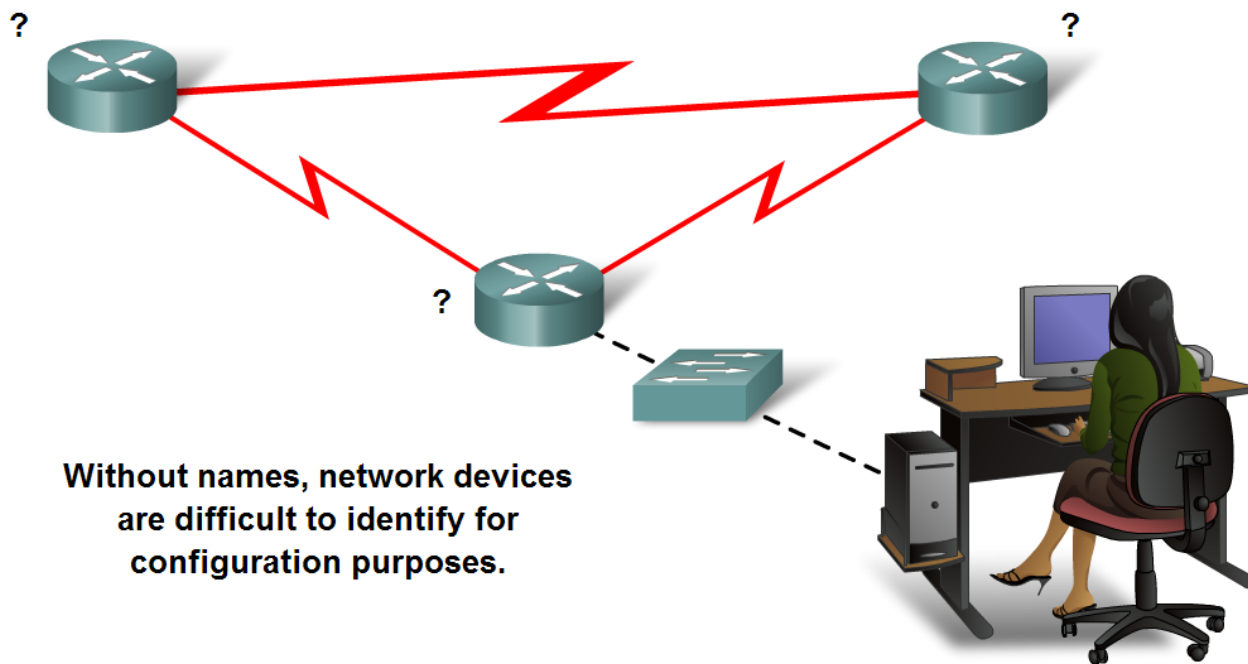
Accessing the Cisco IOS on a Device



Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Explain the reasons for naming devices

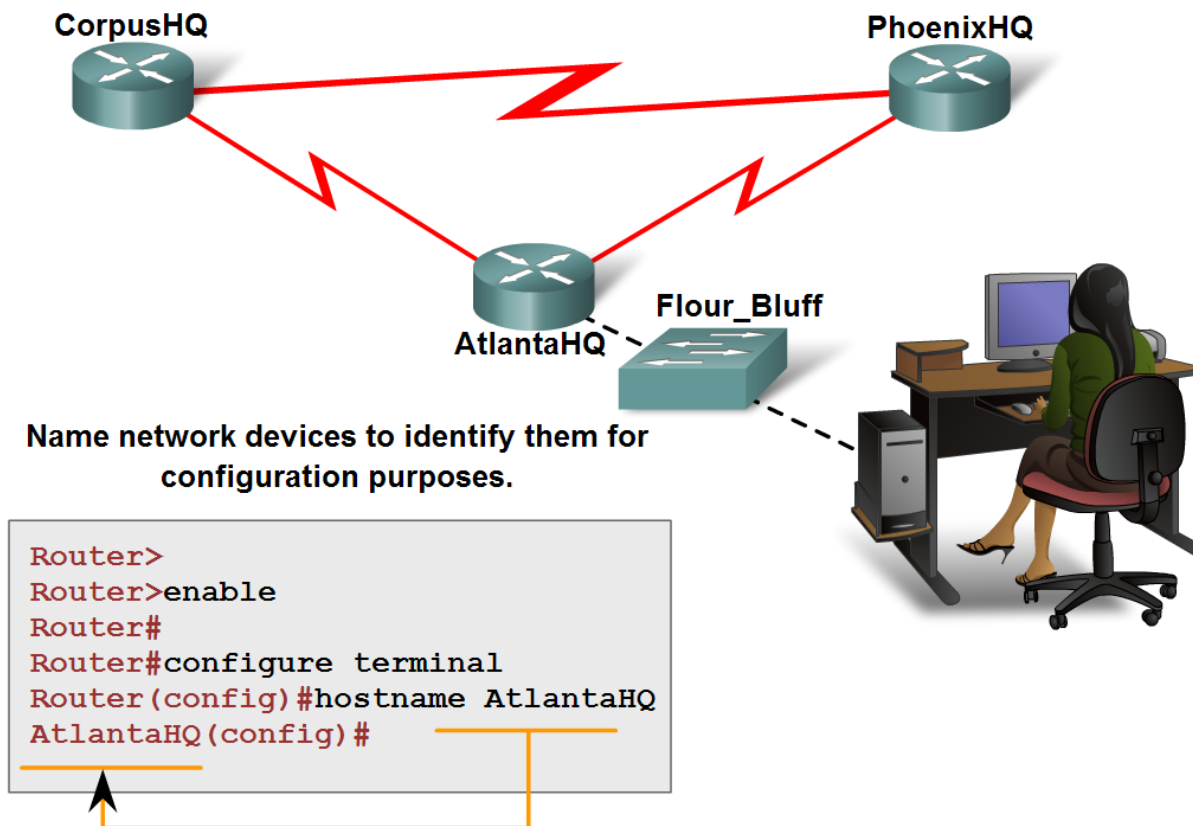
Basic Configuration Using Cisco IOS



Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Describe two common approaches to establishing naming conventions

Configuring Device Names



Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Based on a diagram, configure host names using the CLI



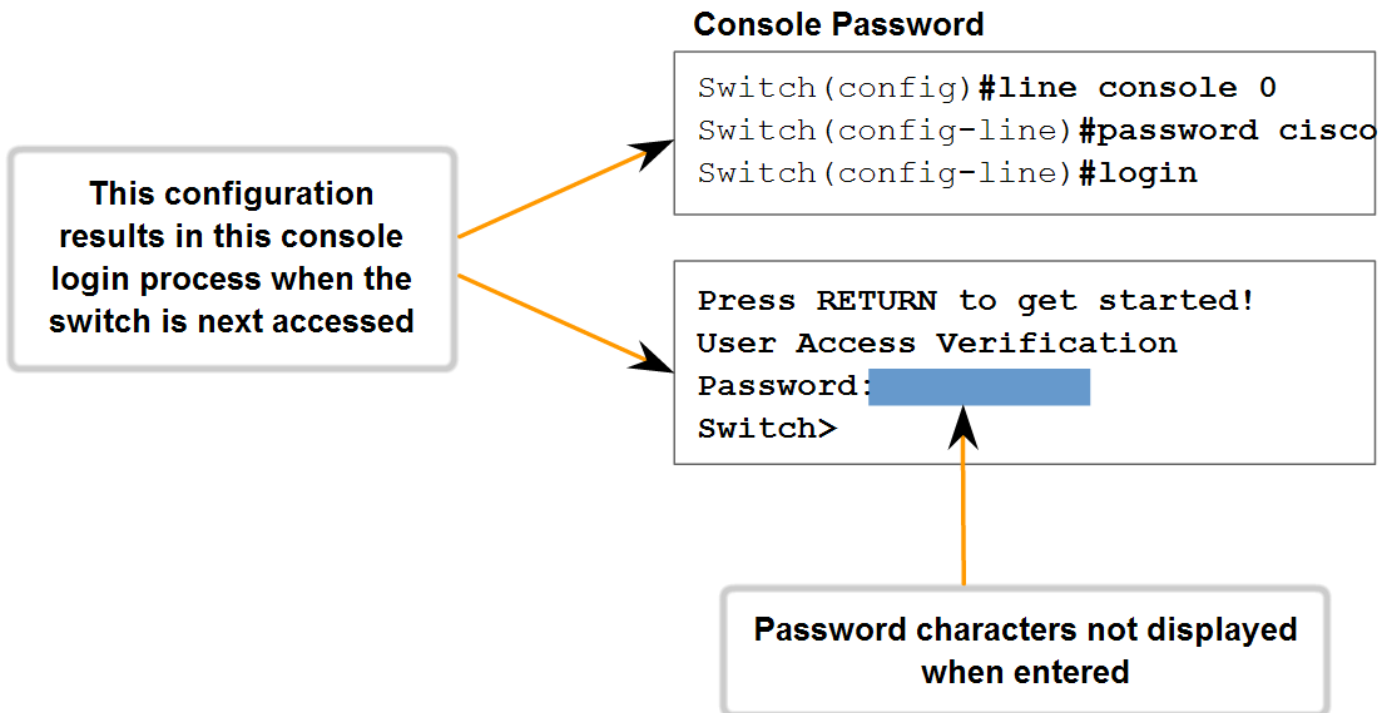
Packet Tracer Exploration:
Configuring Hostnames on Routers and Switches



Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Describe the role of passwords in limiting access to device configurations

Limiting Device Access - Configuring Console Passwords



Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Describe several ways in which access to a device configuration can be limited

Limiting Device Access Configuring Telnet and Password Encryption

Virtual Terminal Password

```
Router(config)#line vty 0 4
Router(config-line)#password cisco
Router(config-line)#login
```

Enable Password

```
Router(config)#enable password san fran
```

Enable Secret Password

```
Router(config)#enable secret cisco
```

Strongly encrypted password

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Use the CLI to set passwords and add banners to a device

Limiting Device Access – Login Banner

```
LAB_A(config)#banner motd # This is a secure system. Authorized Access ONLY!!! #
```

Delimiting characters not included in message

This configuration results in this message of the day banner

```
Router
LAB_A con0 is now available
Press RETURN to get started.
This is a secure system. Authorized Access ONLY!!!
User Access Verification
password:
LAB_A>enable
Password:
LAB_A#
```

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Trace the steps used to examine the startup config, make changes to config, and replace the startup config with the running config

Checking Configuration Files

```
Router# show running-configuration
```

Lists the complete configuration currently active in RAM.

The active configuration can be copied to NVRAM.

```
version 12.2

hostname Router

!interface FastEthernet0/0

no ip address
duplex auto
speed auto
shutdown

interface Serial0/0
no ip address
shutdown
!
interface Serial0/1
no ip address
shutdown
```

```
Router# copy running-configuration startup-configuration
```

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

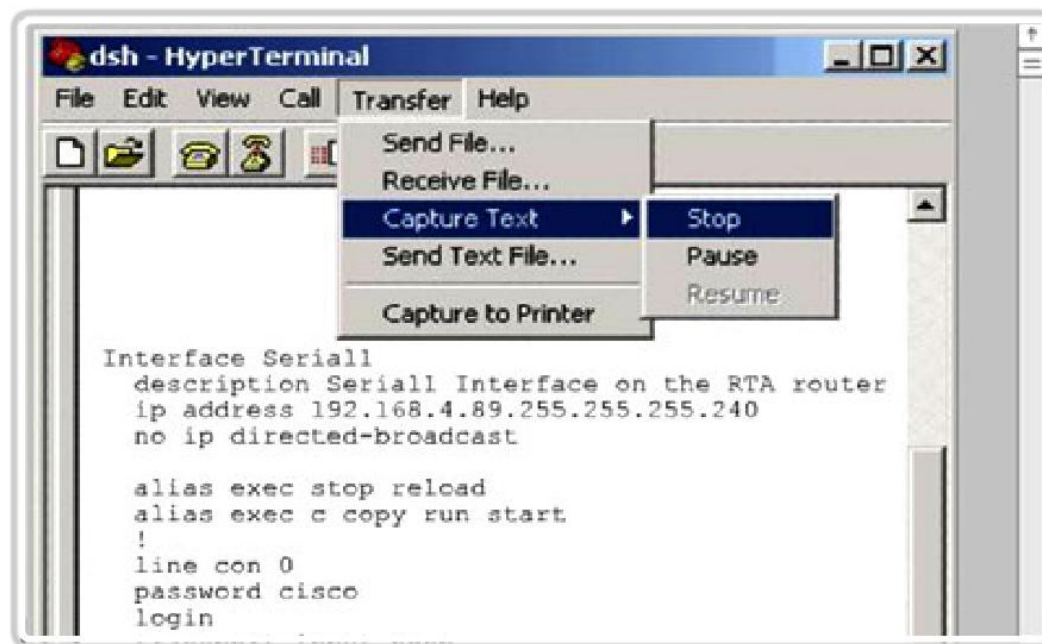
- Use basic IOS config commands to manage a device.

```
Router#copy running-config tftp
Remote host []? 131.108.2.155
Name of configuration file to write[tokyo-config]?tokyo.2
Write file tokyo.2 to 131.108.2.155? [confirm] y
Writing tokyo.2 !!!!!!! [OK]
```

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Use a text file to backup and restore config settings

Saving to a Text File in Hyperterminal



In the terminal session:

1. Start the text capture process
2. Issue a `show running-config` command
3. Stop the capture process
4. Save the text file

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Identify the role of a router in a network.

Configuring Router Interfaces

All interfaces are accessed by issuing the `interface` command at the global configuration prompt.

In the following commands, the *type* argument includes `serial`, `ethernet`, `fastethernet`, and others:

```
Router(config)#interface type port
Router(config)#interface type slot/port
Router(config)#interface type slot/subslot/port
```

The following command is used to administratively turn off the interface:

```
Router(config-if)#shutdown
```

The following command is used to turn on an interface that has been shutdown:

```
Router(config-if)#no shutdown
```

The following command is used to quit the current interface configuration mode:

```
Router(config-if)#exit
```

When the configuration is complete, the interface is enabled and interface configuration mode is exited.

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Describe the purpose of having multiple interfaces in one router

Configuring Router Ethernet Interfaces



```
Router(config)#interface FastEthernet 0/0
Router(config-if)#ip address 192.168.10.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```

Configure Router Ethernet Interfaces

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Explain the purpose of assigning interface descriptions to a router

Router Interfaces Descriptions



```
Router(config)#interface FastEthernet 0/0
Router(config-if)#description Building B Sales LAN
Router(config-if)#exit
```

Description is all text after this space

Interface description used for internal network documentation

```
Router(config)#interface Serial 0/0/0
Router(config-if)#description To Perth CKT-PT27834365-01
Router(config-if)#exit
```

Description is all text after this space

Use Cisco CLI Commands to Perform Basic Router & Switch Configuration and Verification

- Assign a router interface, assign a meaningful interface description, and enable the interface



Packet Tracer Exploration: Configuring Interfaces



Select, Apply, and Verify Appropriate Addressing Parameters to a Host

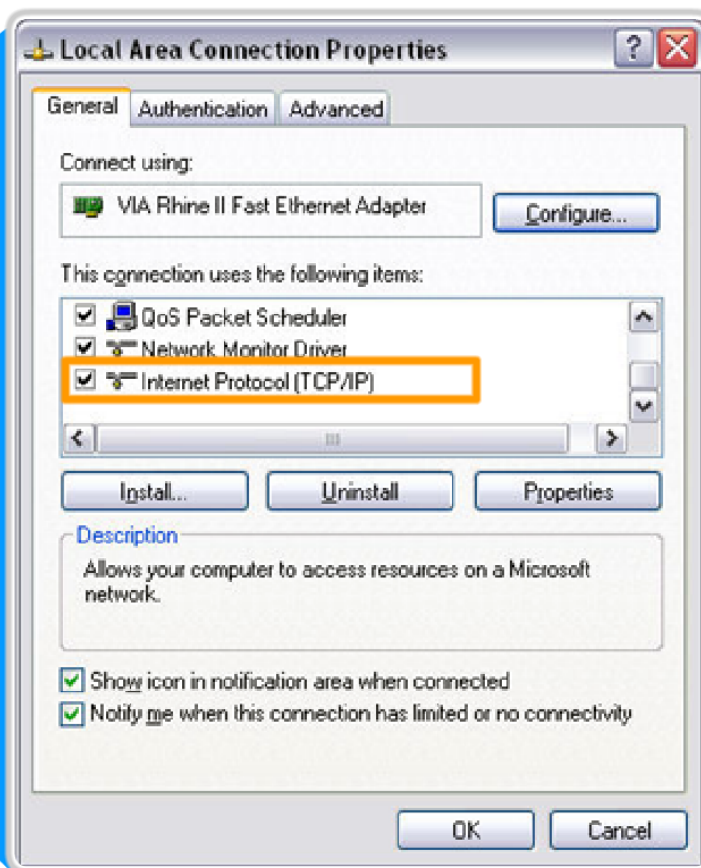
- Given a type of host and a master addressing scheme, trace the steps for assigning host parameters to a host

Testing Local TCP/IP Stack

Pinging the local host confirms that TCP/IP is installed and working on the local network adapter.

C:>ping 127.0.0.1


Pinging 127.0.0.1 causes a device to ping to itself.



Select, Apply, and Verify Appropriate Addressing Parameters to a Host

- Trace the steps for using ipconfig/ifconfig to verify host parameter assignments and for using ping to test assignments

Device Output



Interface Testing

```
Router1#show ip interface brief
Interface      IP-Address      OK?  Method  Status        Protocol
FastEthernet0/0 192.168.254.254 YES   NVRAM    up             up
FastEthernet0/1/0 unassigned      YES   unset    down           down
Serial0/0/0     172.16.0.254   YES   NVRAM    up             up
Serial0/0/1     unassigned      YES   unset    administratively down down

Router1#ping 192.168.254.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.254.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

Router1#traceroute 192.168.0.1
Type escape sequence to abort.
Tracing the route to 192.168.0.1
 0 172.16.0.253 8 msec 4 msec 8 msec
 1 10.0.0.254 16 msec 16 msec 8 msec
 2 192.168.0.1 16 msec * 20 msec
```


Router1

Switch1

Select, Apply, and Verify Appropriate Addressing Parameters to a Host

- Identify two ways parameters can be assigned to hosts

Device Output



Interface Testing

```
Switch1#show ip interface brief
Interface      IP-Address      OK? Method Status      Protocol
Vlan1          192.168.254.250 YES manual  up          up
FastEthernet0/1 unassigned      YES unset  down        down
FastEthernet0/2 unassigned      YES unset  up          up
FastEthernet0/3 unassigned      YES unset  up          up
<output omitted>
```

```
Switch1#ping 192.168.254.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.254.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

```
Switch1#traceroute 192.168.0.1
Type escape sequence to abort.
Tracing the route to 192.168.0.1
 0 192.168.254.254  4 msec 2 msec 3 msec
 1 172.16.0.253    8 msec 4 msec 8 msec
 2 10.0.0.254     16 msec 16 msec 8 msec
 3 192.168.0.1    16 msec * 20 msec
```

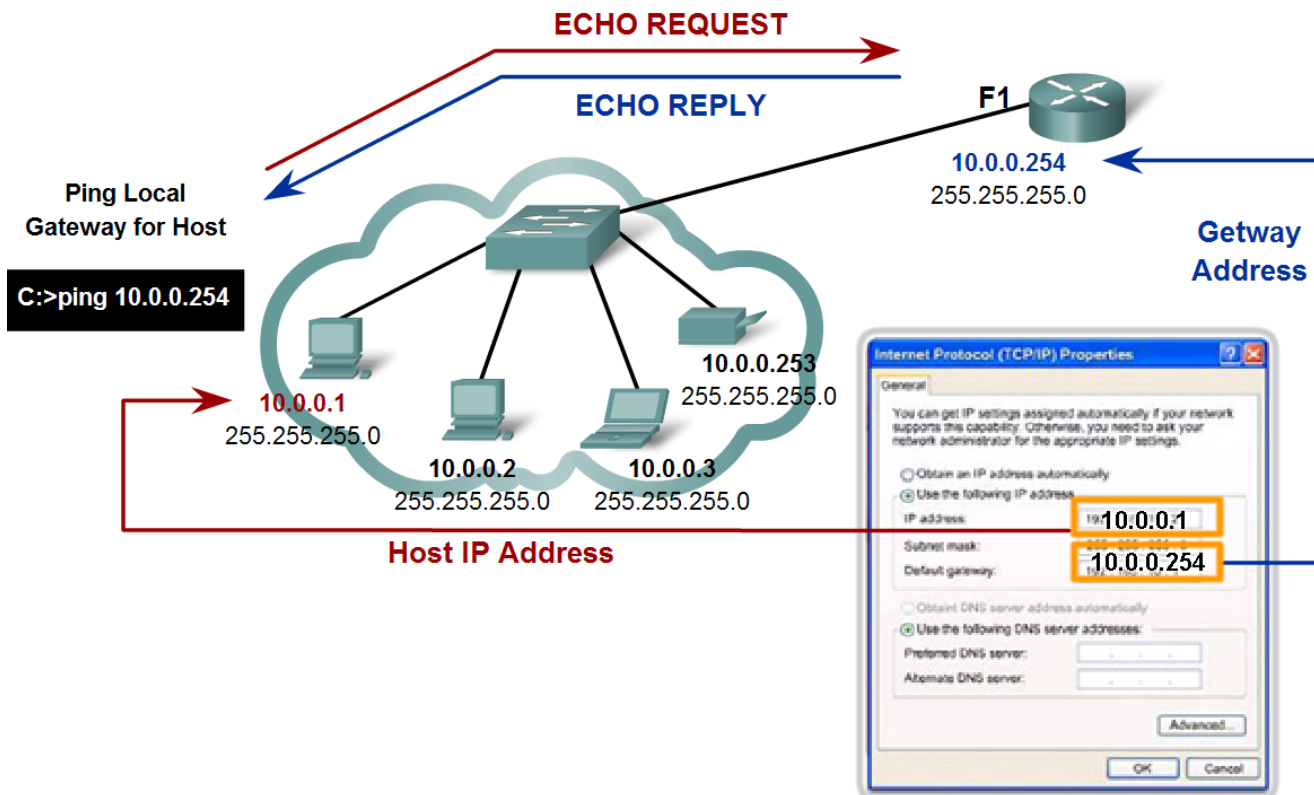
Router1

Switch1

Use Common Utilities to Verify Network Connectivity Between Hosts

- Use the ping command in the CLI to determine if the IP protocol is operational on a local host

Testing Gateway Connectivity



Use Common Utilities to Verify Network Connectivity Between Hosts

- Use the ping command to determine if the IP protocol is properly bound to an NIC

Testing the Local NIC Assignment

```
IP Address. . . . . : 10.0.0.5
Subnet Mask . . . . . : 255.255.255.0
Default Gateway. . . . : 10.0.0.254
```



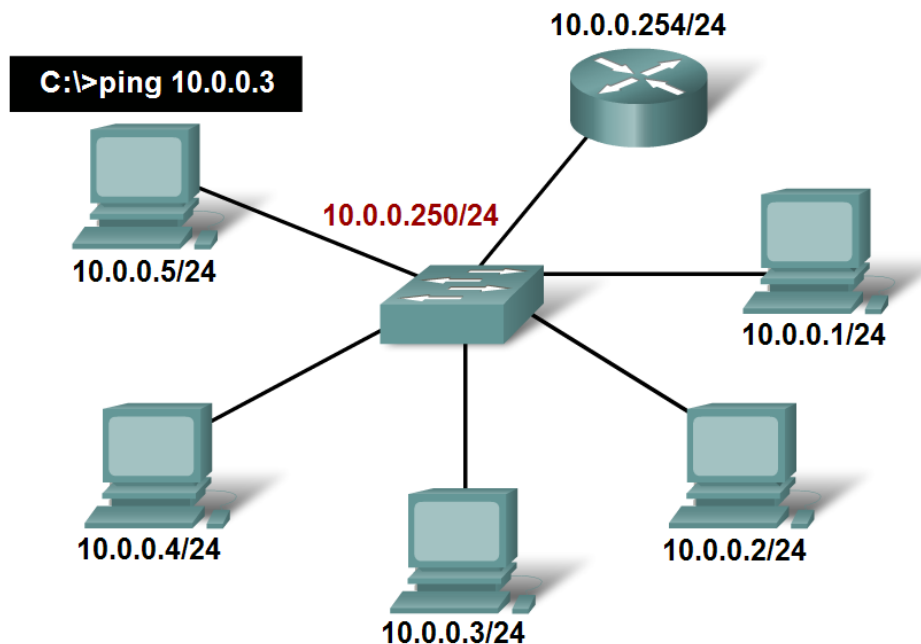
Verify the host NIC address is bound and ready for transmitting signals across the media by pinging its own IP address.

Use Common Utilities to Verify Network Connectivity Between Hosts

- Use the ping command to determine if a host can actively communicate across the local network

Testing Local Network

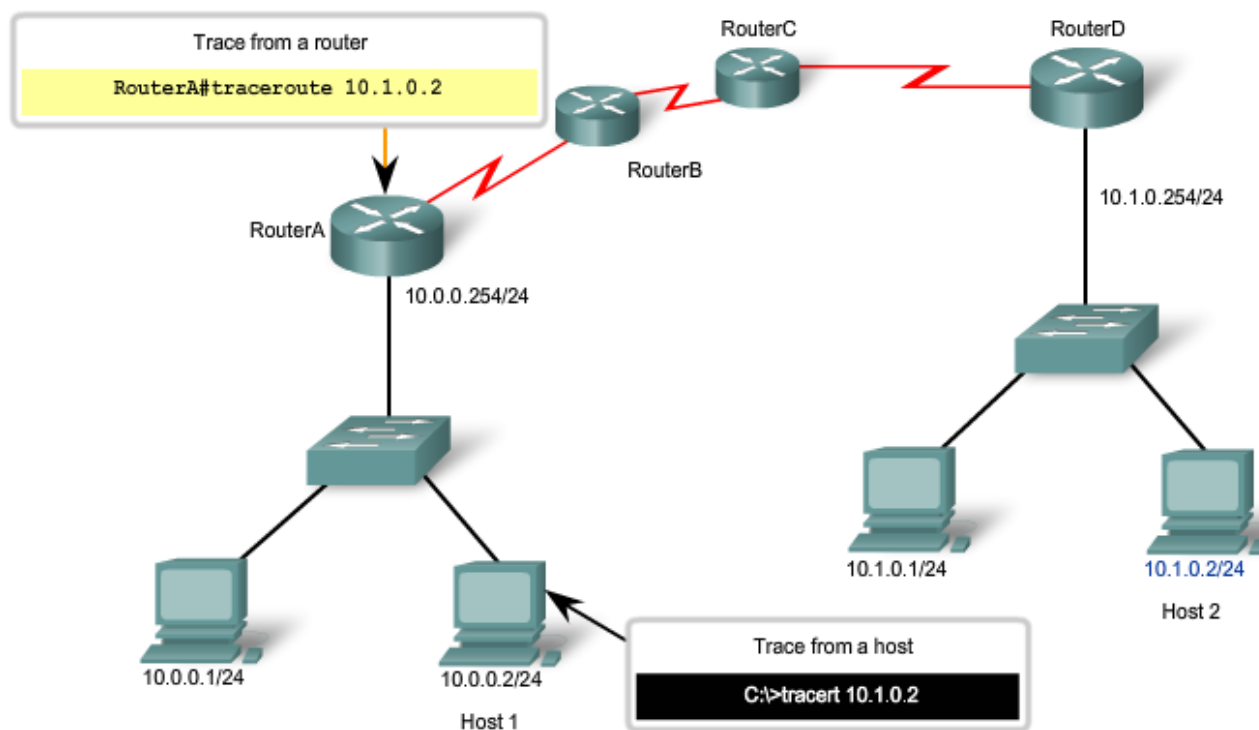
Successfully pinging the other host's IPv4 addresses will verify that not only the local host is configured properly but the other hosts are configured correctly as well.



Use Common Utilities to Verify Network Connectivity Between Hosts

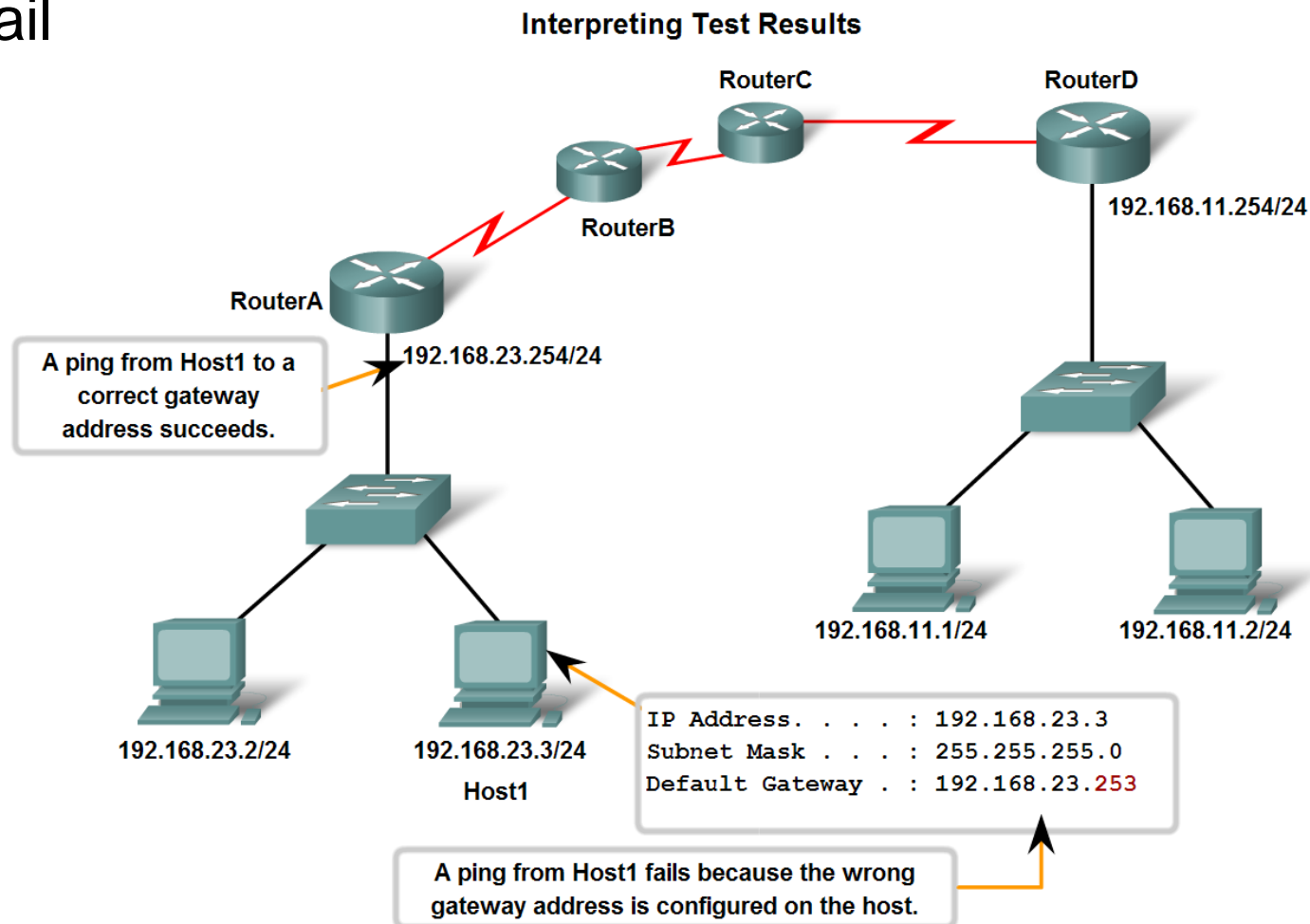
- Use the ping command to verify that the local host can communicate across the internetwork to a given remote host.

Testing the Path to a Remote Host



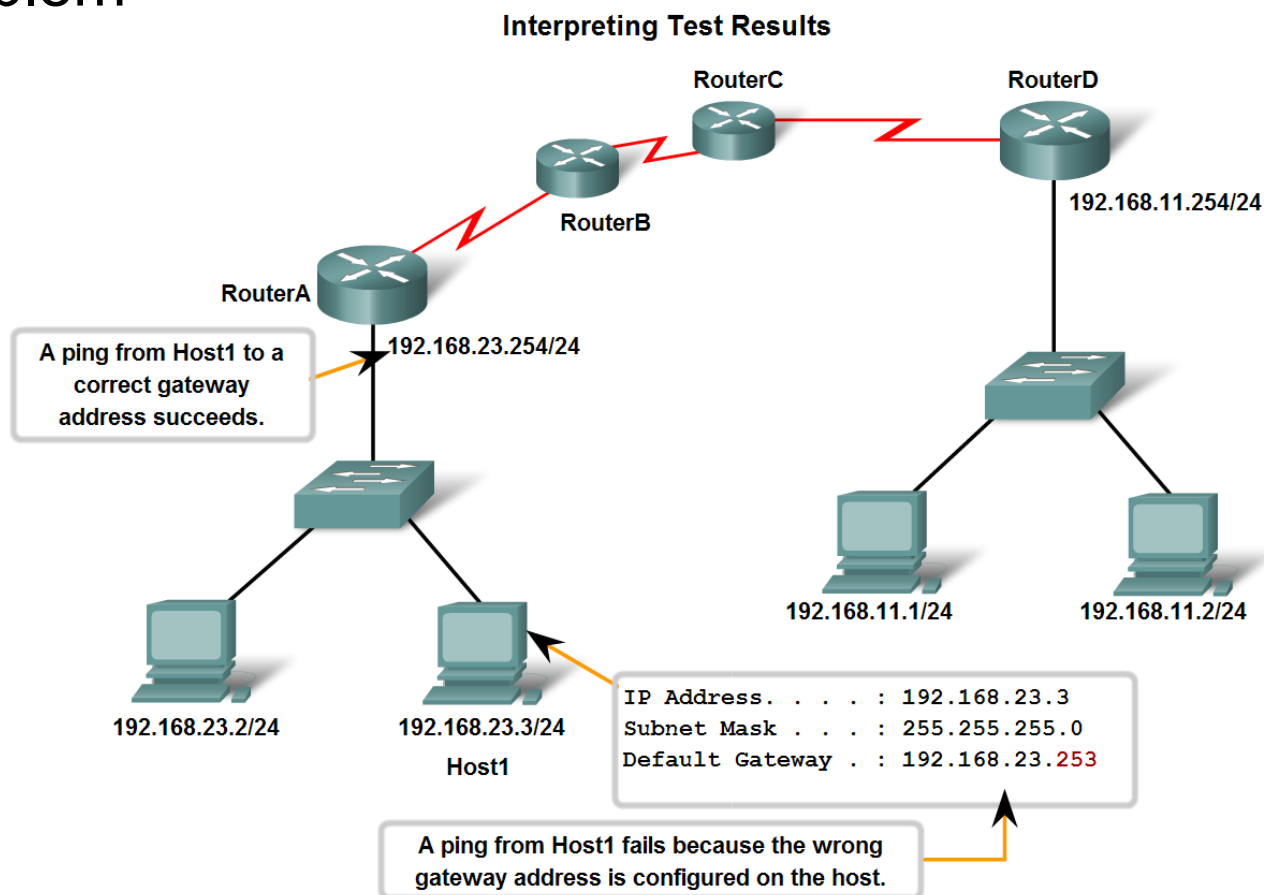
Use Common Utilities to Verify Network Connectivity Between Hosts

- Identify several conditions that might cause the test to fail



Use Common Utilities to Verify Network Connectivity Between Hosts

- Use trace commands to identify network connectivity problem



Use Common Utilities to Establish a Relative Performance Baseline for the Network

- Use the output of the ping command, saved into logs, and repeated over time, to establish relative network performance

Baseline with ping

FEB 2, 2007 08:14:43

```
C:\host1>ping 10.66.254.159

Pinging 10.66.254.159 with 32 bytes of data:

Reply from 10.66.254.159: bytes=32 time<1ms TTL=128
Reply from 10.66.254.159: bytes=32 time<1ms TTL=128
Reply from 10.66.254.159: bytes=32 time<1ms TTL=128
Reply from 10.66.254.159: bytes=32 time<1ms TTL=128
```

MAR 17, 2007 14:41:06

```
C:\host1>ping 10.66.254.159

Pinging 10.66.254.159 with 32 bytes of data:

Reply from 10.66.254.159: bytes=32 time<6ms TTL=128
Reply from 10.66.254.159: bytes=32 time<6ms TTL=128
Reply from 10.66.254.159: bytes=32 time<6ms TTL=128
Reply from 10.66.254.159: bytes=32 time<6ms TTL=128
```

Use Common Utilities to Establish a Relative Performance Baseline for the Network

- Use the output of the traceroute command, saved into logs, and repeated over time, to establish relative network performance

Capturing Trace Route

```
C:\>tracert www.cisco.com

Tracing route to www.cisco.com [198.133.219.25]
over a maximum of 30 hops:

  1      1 ms      <1 ms      <1 ms      192.168.0.1
  2      20 ms      20 ms      20 ms      nexthop.wa.ii.net [203.59.14.16]
  3      20 ms      19 ms      20 ms      gi2-4.per-qvl-bdrl.ii.net [203.215.4.32]
  4      79 ms      78 ms      78 ms      gi0-14-0-0.syd-ult-core1.ii.net [203.215.20.2]
  5      79 ms      81 ms      79 ms      202.139.19.33
  6     227 ms     228 ms     227 ms      203.208.148.17
  7     227 ms     227 ms     227 ms      203.208.149.34
  8     225 ms     225 ms     226 ms      208.30.205.145
  9     236 ms     249 ms     233 ms      sl-bb23-ana-8-0-0.sprintlink.net [144.232.9.23]

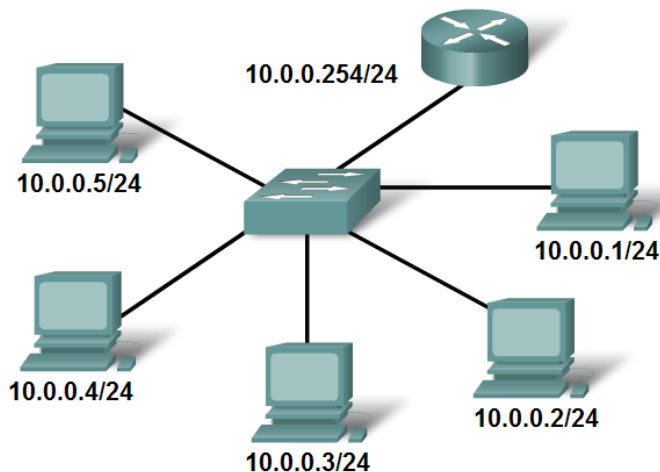
 10     241 ms     244 ms     240 ms      sl-bb25-sj-9-0.sprintlink.net [144.232.20.159]
 11     238 ms     238 ms     239 ms      sl-gw8-sj-10-0.sprintlink.net [144.232.3.114]
 12     238 ms     239 ms     240 ms      144.228.44.14
 13     240 ms     242 ms     248 ms      sjce-dmzbb-gw1.cisco.com [128.107.239.89]
```

Sample trace output

Use Common Utilities to Establish a Relative Performance Baseline for the Network

- Trace the steps for verifying the physical addresses of the hosts

Learning About the Nodes on the Network



```

C:\>arp -a
Internet Address      Physical Address      Type
10.0.0.2              00-08-a3-b6-ce-04     dynamic
10.0.0.3              00-0d-56-09-fb-d1     dynamic
10.0.0.4              00-12-3f-d4-6d-1b     dynamic
10.0.0.254            00-10-7b-e7-fa-ef     dynamic
  
```

IP- MAC Address Pair

Summary

In this chapter, you learned to:

- Define the role of the Internetwork Operating System (IOS).
- Define the purpose of a configuration file.
- Identify several classes of devices that have the IOS embedded.
- Identify the factors contributing to the set of IOS commands available to a device.
- Identify the IOS modes of operation.
- Identify the basic IOS commands.
- Compare and contrast the basic show commands.

